REMARKS

Applicant thanks the Examiner for her indication that claims 12, 13, 36 and 37 contain allowable subject matter.

Claims 1-43 are pending in the application. Claims 5, 8 and 37 stand objected-to as reciting language without antecedent basis. In particular, the Examiner points out that the language "the overclad layer" in claim 5, and "the inner layer" in claim 37, lack antecedent basis and that claim 8 is properly dependent upon claim 7. Claims 5, 8 and 37 have been amended accordingly.

Claims 1-4, 6-10, 33 And 34 Are Patentable Over Inniss

Claims 1-4, 6-10, 33 and 34 stand rejected as being anticipated by U.S. Patent No. 5,214,734 to Inniss et al ("Inniss"). This rejection is respectfully traversed for the reasons set forth below.

Inniss teaches an optical fiber which is enclosed within a polymeric jacket for environmental protection and protection against handling. At column 3, lines 3-12 Inniss states:

> With further reference to Fig. 1 (ES: Fig. 1 is an outside view at a three material structure that consist of a silica fiber and two coating layers), a single polymer layer may be applied, or, alternatively, a multiple-layer jacket, including a primary layer 20, closest to the fiber and at least one secondary layer 30, may be formed on the fiber. In contrast to the prior art, at least one primary and/or secondary layer is filled with particulate, e.g. fumed, silica. The silica filled layer may be the sole layer of the jacket, as is currently preferred, or alternatively, it may be any layer or layers of a multiple-layer jacket.

At column 3 lines 50-56 Inniss further states:

> One acceptable preparation of particulate is fumed silica which is commercially available from the Cabot Corporation, Cab-O-Sil Division, of Tuscola, Illinois under the trade name CAB-O-SIL®. Various grades of CAB-O-SIL® are available having an average primary particle diameter ranging from 7mm (BET surface area of 380 m2/g) to 24 nm (BET surface area of 90 m2/g).

Inniss' approach and its distinctions from the present invention become absolutely clear when it indicates that the nano-particles used are commercially available fumed silica particles. Fumed silica nanoparticles are hydrophilic, i.e., they absorb moisture. They act as a dessicant, i.e., they absorb moisture. If and until these particles do their job, the surface of the silica cladding is protected against "new" water that might reach the silica cladding surface.

Moreover, the disclosure of Inniss is directed solely to a fiber with a polymer coating.

The presently claimed invention, on the other hand, is a novel nano-particle material cladding layer. In particular, Applicant's claim 1 recites, *inter alia*, an optical fiber having a cladding layer including a plurality of nano-particles around the core. Independent claim 33 likewise recites a cladding layer that includes nano-particles. Those of ordinary skill in the art will recognize that Inniss' disclosure of a fiber coating does not teach or suggest the presently claimed cladding layer including a plurality of nano-particles around the core.

The Court of Appeals for the Federal Circuit has consistently held that "Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim." Lindemann Maschinenfabirk Gmbh v. American Hoist & Derrick, 221 USPQ 481, 485 (Fed. Cir.

1984). Inniss clearly fails to disclose structure and steps positively recited and claimed in applicant's independent claims 1 and 33. Thus, claims 1 and 33, and their dependent claims 2-4, 6-10, and 34 are patentable over Innis.

While dependent claims 3, 7, 8 and 10 inherit the limitations of independent claim 1 from which they depend, and are thus patentable over Inniss for all of the reasons set forth above, these dependent claims are further distinguished from Inniss in the following manner. Claim 3 recites a filler that includes at least one of a polymer, synthetic oil, poly-silopane and Teflon. None of these materials are taught or suggested by Inniss for a filler. Claim 7 recites a cladding layer that includes nanoparticles of at lease one of a ceramic, silica, molybolenum disulfide, Teflon and a metallic oxide. None of these materials are taught or suggested by Inniss for a cladding layer. Claim 8 recites a cladding of metallic oxide comprising one of titanium oxide, aluminum oxide and magnesium oxide. None of these materials are taught or suggested by Inniss for a metallic oxide of a cladding layer. Claim 10 recites that the nanoparticles of the cladding layer are a mix of hydrophilic and hydrophobic particles. This mixture is not taught or suggested by Inniss for a cladding layer. Thus, claims 3, 7, 8 and 10 are even further distinguishable from, and patentable over, Inniss.

Claims 1, 4, 5, 7 and 8 Are Patentable Over Kengo

Claims 1, 4, 5, 7 and 8 stand rejected under 35 U.S.C. 102(b) as being anticipated by published PCT Application No. WO 00/25159 to Kengo et al. ("Kengo"). This rejection is respectfully traversed for the reasons set forth below.

Kengo is directed to sidelight extraction type light fibers and methods for producing them. Kengo states at page 6 lines 3-26 that:

> Preferably, a cladding of a light fiber 10 comprises:
>
> - a light diffusive layer 3 made of a light diffusive material containing, as a binder, a polymer having a refractive index smaller than that of the core, which is provided in closely [sic] contact with the core in a wall thickness of 1 to 300 μm in a circumferential direction, and a protective layer 4 made of a light transmitting resin material, which is formed to integrate with the light diffusive layer 3 and covers the light diffusive layer 3.
>
> When the core 1 is made of the above described polymer having a refractive index of about 1.5, the light diffusive material of the light diffusive layer 3 preferably contains a light transmitting fluorine polymer have a refractive index of 1.34 to 1.43, which is smaller than that of the polymer, such as tetrafluoroethylene-hexafluropropylene copolymer (FEP), tetrafluoroethylene-ethylene (ETFE) or tetrafluoroethylene-hexafluoropropylene-vinylidene fluoride copolymer (THV) as a binder. The light diffusive material preferable contains for example, a light scattering material 5 having a particle size of about 10 nm to 300 μm, together with this binder.
>
> As the light scattering material, beads consisting of glass or other materials or titanium dioxide particles are generally used. Then light scattering material may also be these other than titanium dioxide as far as the effect of the present invention is not adversely affected. Specific examples thereof include white inorganic powder and coloring pigment, which have a refractive index within a range from 1.5 to 3.0. As the white inorganic powder, for example, barium sulfate (refractive index 1.51), magnesia (refractive index 1.8), titania (refractive index 2.6) or the like is preferred. It is also possible to contain a coloring material such as fluorescent dye, together with a light scattering material and to extract white light fed to the core as colored light.

The problem that Kengo attempts to solve is completely different than the problem addressed by the claimed invention. Kengo intends to "provide a side light extraction type light fiber capable of extracting light having high brightness at a viewing angle." See abstract. This is why Kengo tries to create a light diffusive material and to achieve an effect of scattering. The present invention, on the contrary, aims at creating a

cladding material with a high reflecting capability, in order to create the effect of total internal reflection. Although Kengo deals with optical fibers, it is aimed at creating a "side light extraction" type of a fiber for emitting incident light from at least one end in a longitudinal direction of the core through a cladding." This is why it is important that highly scattered illumination is achieved. In accordance with the present invention, it is the low refractive index, a low Young's modulus, and high water repellency that are important. The invention provides fibers intended for communications and as optical interconnects. In accordance with Kengo, only optical properties of the cladding are important (and these properties are supposed to be quite different of, and even opposite to, the properties of "our" fiber), while in the present invention mechanical properties (Young's modulus) and environmental (high moisture resistance) properties are equally important. Thus, the object of the invention is different (communication and sensor fiber vs. light extraction fiber), the desired properties are different and even opposite (good reflection vs good scattering), the type of nanoparticles is different (no hydrophobic or partially hydrophilic or partially hydrophobic particles are employed in Kengo).

Applicant has amended claim 1 to clarify that the cladding layer including a plurality of nano-particles around the core provides improved moisture resistance. This element is not taught or suggested by Kengo and, thus, claim 1 and its dependent claims 4, 5, 7 and 8 are patentable thereover.

While dependent claim 5 inherits the limitations of claim 1 from which it depends, and is patentable over Kengo for all of the reasons set forth above, this claim is further distinguishable from Kengo. Applicant's claim 5 recites an overclad layer including Teflon. Kengo suggests only that Teflon is used in the "inner light diffusive

layer of the cladding," and does not teach or suggest in any manner using Teflon in an overclad layer. Thus, claim 5 is further distinguishable from, and patentable over, Kengo.

Claims 22-25 And 43 Are Patentable Over Dawes

Claims 22-25 and 43 stand rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,519,380 to Dawes et al ("Dawes"). This rejection is respectfully traversed for the reasons set forth below.

The disclosure of Dawes relates to optical waveguides, and not to optical fibers. Fig. 5A of Dawes depicts a typical planar structure, in which the overclad contains organic materials in combination with a silica or doped silica. Column 14, lines 41-48, of Dawes further states:

> In another preferred embodiment of the invention, the hybrid overclad method is employed. In the hybrid method the overclad is preferably made by mixing a polymer overclad material with silica nano-particles. The mixture of the negative dn/dt polymer with positive dn/dt silica provides a material with a less negative dn/dt, suitable for overcladding the device of the invention.

Dawes' objective, as it is described in the "Field of the Invention" section at column 1, lines 6-12, is to create a planar lightguide in which:

> ...the light transmitting properties are insensitive to temperature variations and fluctuations. More particularly, the invention is directed to athermalized integrated planer optical waveguide devices with organic containing overclads containing silicate glasses, polymers, and/or hybrid (organic/inorganic) sol-gels.

The nanoparticles disclosed by Dawes are used to stabilize the refractive index and to make it less sensitive to temperature variations. The present invention does not address this objective at all. While both Dawes and the present invention utilize some kind of nanoparticles, they are used to achieve fundamentally different objectives with

fundamentally different structures. Dawes discloses using unmodified silica particles with a less negative dn/dt than polymer to reduce the temperature change sensitivity of the overclad mixture. The present invention utilizes various kines of silica particles (hydrophilic, hydrophobic, etc.) to achieve low refractive index of the cladding and to create a cladding with a low Young's modulus and high resistance to moisture. Dawes is directed to a planar lightguide. The present invention, on the other hand, relates predominantly to optical fibers.

Claim 22 of the present application recites an optical transmission structure comprising a substrate, a waveguide on the substrate, and a cladding layer including a plurality of nano-particles over the waveguide, and claim 43 recites a method of manufacturing such a structure. The claimed particles are different than those disclosed by Dawes, and the reason that they are employed is different as well. The claimed invention provides a low Young's modulus for lower induced stresses, primarily thermal stresses, and high moisture resistance. Claims 22 and 43 have been amended to clarify this distinction. Dawes et al, on the other hand, introduce nano-particles for improving the stability of the refractive index with respect to temperature variation, and does not teach or suggest a cladding layer including a plurality of nano-particles over the waveguide, wherein the nano-particles provide a lowered Young's modulus and increased moisture resistance.

In view of all of the above, claims 22-25 and 43 are patentable over Dawes.

Claim 14 Is Patentable Over Inniss In View Of Perelman

Claim 14 stands rejected under 35 U.S.C. 103(a) as unpatentable over Inniss as applied to claim 1 above, and further in view of U.S. Patent No. 4,368,350 to Perelman ("Perelman"). This rejection is respectfully traversed for the reasons set forth below.

Claim 14 is dependent upon claim 1, and inherits all the limitations thereof. Thus, claim 14 is patentable over Inniss for all of the reasons set forth above with respect to claim 1, *viz*, Inniss fails to teach or suggest an optical fiber having a cladding layer including a plurality of nano-particles around the core. Perelman is directed to a corrugated coaxial cable and likewise fails to teach or suggest an optical fiber with a cladding layer including a plurality of nano-particles around the core.

For all of the above reasons, claim 14 is patentable over Inniss in view of Perelman.

Claim 15 Is Patentable Over Inniss In View Of Gleason

Claim 15 stands rejected under 35 U.S.C. 103(a) as unpatentable over Inniss as applied to claim 1 above, and further in view of U.S. Patent No. 6,349.161 to Gleason ("Gleason"). This rejection is respectfully traversed for the reasons set forth below.

Claim 15 is dependent upon claim 1, and inherits all the limitations thereof. Thus, claim 15 is patentable over Inniss for all of the reasons set forth above with respect to claim 1, *viz*, Inniss fails to teach or suggest an optical fiber having a cladding layer including a plurality of nano-particles around the core. Gleason is directed to a an undersea communications cable having a hollow buffers tube with an optical fiber bundle therein, and likewise fails to teach or suggest an optical fiber with a cladding layer including a plurality of nano-particles around the core. Gleason further fails teach or

suggest the use of the thixotropic properties of any nano-particle containing material, or any other material.

For all of the above reasons, claim 15 is patentable over Inniss in view of Gleason.

Claims 16-20 and 26 Are Patentable Over Innis

Claims 16-20 and 26 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Innis. This rejection is respectfully traversed for the reasons set forth below.

Independent claim 16 is directed to a bundle of optical fibers having the structure recited in claim 1, except that the same cladding layer covers a plurality of cores. Claim 16, and its dependent claims 17-20, are patentable for all of the reasons set forth above with respect to claim 1, *viz*, Inniss fails to teach or suggest a cladding layer including a plurality of nano-particles over the waveguides and between the waveguides.

Independent claim 26 is patentable over Inniss because Inniss fails to teach or suggest opticals fiber having a cladding layer including a plurality of nano-particles over the waveguide.

For all of the above reasons, claims 16-20 and 26 are patentable over Innis.

Claims 10, 11, 32 and 35 Are Patentable Over Inniss In View Of Girgis

Claims 10, 11, 32 and 35 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Inniss in view of U.S. Patent No. 6,087,000 to Girgis ("Girgis"). This rejection is respectfully traversed for the reasons set forth below.

Claims 10 and 11 depend from claim 1, and are patentable over Inniss for all of the reasons set forth above with respect to claim 1, *viz*, Inniss fails to teach or suggest an

optical fiber having a cladding layer including a plurality of nano-particles around the core. Girgis is directed to a plurality of optical fibers coated with a hydrophobic flourine-containing polymer, and also fails to teach or suggest an optical fiber having a cladding layer including a plurality of nano-particles around the core.

Claim 32 depends from claim 26 and is patentable over Inniss for all of the reasons set forth above with respect to claim 26, *viz*, Inniss fails to teach or suggest an optical transmission structure having a cladding layer including a plurality of nano-particles over the waveguides and between the waveguides. Girgis also fails to teach or suggest an optical transmission structure having a cladding layer including a plurality of nano-particles over the waveguides and between the waveguides.

Claim 35 depends from claim 33, and is patentable over Inniss for all of the reasons set forth above with respect to claim 33, *viz*, Inniss fails to teach or suggest a cladding layer that includes nano-particles. Girgis also fails to teach or suggest a cladding layer that includes nano-particles.

For all of the reasons set forth above, claims 10, 11, 32 and 35 are patentable over Inniss in view of Girgis. Applicant further notes that Girgis is not prior art to the present application.

Claim 21 Is Patentable Over Inniss In View Of Girgis

Claim 21 stands rejected under 35 U.S.C. 103(a) as unpatentable over Inniss in view of Girgis. This rejection is respectfully traversed for the reasons set forth below.

Claim 21 depends from claim 16 and is patentable over Inniss for all of the reasons set forth above with respect to claim 16, *viz*, Inniss fails to teach or suggest a

cladding layer including a plurality of nano-particles. Girgis is directed to a plurality of optical fibers coated with a hydrophobic flourine-containing polymer, and also fails to teach or suggest a cladding layer including a plurality of nano-particles.

For all of the reasons set forth above, claim 21 is patentable over Inniss in view of Girgis. Applicant further notes that Girgis is not prior art to the present application.

Claims 26-31 Are Patentable over Dawes In View Of Ooba

Claims 26-31 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Dawes in view U.S. Patent No. 6,122,416 to Ooba et al. ("Ooba"). This rejection is respectfully traversed for the reasons set forth below.

The disclosure of Dawes is characterized above with respect to claim 22 and will not be repeated here. Ooba discloses a stacked thermo-optic switch. Claim 26, like claim 22, recites a cladding layer including a plurality of nano-particles, the nano-particles providing a lowered Young's modulus and increased moisture resistance. Neither Dawes nor Ooba teach or suggest such use of nano-particles.

For all of the above reasons, claim 26 and its dependent claims 27-31 are patentable over Dawes in view of Ooba.

Claim 38 Is Patentable Over Inniss In View of Horikoshi

Claim 38 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Inniss in view of Japanese Patent No. JP402252632A to Horikoshi ("Horikoshi"). This rejection is respectfully traversed for the reasons set forth below.

Claim 38 depends from claim 33, and is patentable over Inniss for all of the reasons set forth above with respect to claim 33, *viz*, Inniss fails to teach or suggest coating a fiber core with a cladding layer that includes nano-particles. Horikoshi is directed to the production of optical fiber preforms and also fails to teach or suggest such coating step.

For all of the above reasons, claim 38 is patentable over Inniss in view of Horikoshi.

Claim 39 Is Patentable Over Inniss In View Of Kanda

Claim 39 stands rejected under 35 U.S.C. 103(a) over Inniss in view of U.S. Patent No. 4,740,055 to Kanda et al. ("Kanda"). This rejection is respectfully traversed for the reasons set forth below.

Claim 39 depends from claim 33 and is patentable over Inniss for all of the reasons set forth above with respect to claim 33, *viz*, Inniss fails to teach or suggest the step of coating a fiber core with a cladding layer that includes nano-particles. Kanda is directed to an optical fiber with a polymer microparticle (not nanoparticle) coating, and also fails to teach or suggest coating a fiber core with a cladding layer that includes nano-particles.

In view of the above, claim 39 is patentable over Inniss in view of Kanda.

Claim 40 Is Patentable Over Inniss In View Of Freidinger

Claim 40 stands rejected under 35 U.S.C. 103(a) over Inniss in view of German Patent No. DE3919067 to Freidinger et al. ("Freidinger"). This rejection is respectfully traversed for the reasons set forth below.

Claim 40 depends from claim 33 and is patentable over Inniss for all of the reasons set forth above with respect to claim 33, *viz*, Inniss fails to teach or suggest a fiber core with a cladding layer that includes nano-particles. Freidinger is directed to coating optical fibers and also fails to teach or suggest a cladding layer that includes nano-particles.

For all of the above reasons, claim 40 is patentable over Inniss in view of Freidinger.

Claims 41 And 42 Are Patentable Over Inniss In View Of Minemoto

Claims 41 and 42 stand rejected under 35 U.S.C. 103(a) over Inniss in view of U.S. Patent No. 5,699,461 to Minemoto et al. ("Minemoto"). This rejection is respectfully traversed for the reasons set forth below.

Claims 41 and 42 depend from claim 33, and are patentable over Inniss for the reasons set forth above with respect to claim 33, *viz*, Inniss fails to teach or suggest a fiber core with a cladding layer that includes nano-particles. Minemoto is directed to optical fiber sensors having a substrate with a U-shaped groove therein, the U-shaped groove encasing a jacketed optical fiber. Minemoto, like Inniss, fails to teach or suggest a cladding layer that includes nano-particles.

In view of the above, claims 41 and 42 are patentable over Inniss in view of Minemoto.

CONCLUSION

Having responded to all objections and rejections set forth in the outstanding Office Action, it is submitted that claims 1-43 are in condition for allowance and Notice to that effect is respectfully solicited. In the event that the Examiner is of the opinion that a brief telephone or personal interview will facilitate allowance of one or more of the above claims, he is courteously requested to contact applicant's undersigned representative.

Respectfully submitted,

Richard E. Kurtz, II
Reg. No.: 33,936

Greenberg Traurig
1750 Tysons Boulevard, 12th Floor
McLean, Virginia 22102
703-903-7533

December 18, 2003